Pain Management in Elderly Trauma Patients

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KEY POINTS

- Adequate pain relief in elderly trauma patients helps with early ambulation and decreases the risk of cardiovascular and respiratory complications and postoperative cognitive dysfunction.
- A thorough understanding of geriatric physiology, pharmacokinetics and pharmacodynamics is essential in elderly trauma patients.
- Multimodal analgesia and the use of regional anaesthesia should be encouraged to minimise systemic side effects of medications in elderly patients.

INTRODUCTION

Advances in medical science have been associated with an increase in life expectancy; this has led to an increase in the geriatric population requiring medical and surgical interventions. This age group is particularly prone to fractures after trivial injuries because of the higher prevalence of osteoporosis. Providing adequate analgesia is important to prevent cardiac and respiratory complications and to restore early ambulation and recovery. This tutorial will cover basic physiology; the principles of pain management including assessment, pharmacologic and regional analgesia techniques; and the management of some specific injuries in elderly patients.

GENERAL CONSIDERATIONS

- Central nervous system[1]: Structurally, there is a decrease in the brain volume with increasing age. There is also a reduction in cerebrospinal fluid volume, epidural space and decreased inter–Schwann cell distance in the peripheral nerves, leading to an increased sensitivity to anaesthetics.
- Cardiovascular system: With advancing age, the arterial walls undergo atherosclerotic changes with increased calcification and vascular stiffness. Autonomic system changes lead to a decrease in response to β-receptor stimulation and an increase in sympathetic nervous system activity. There is decreased β-adrenergic responsiveness and decreased compliance of the ventricular walls, leading to diastolic dysfunction. Concomitant cardiovascular and coronary artery disease is common, which makes the elderly population more prone to myocardial ischaemia and dysfunction.
- Respiratory system: There is a decreased partial pressure of oxygen, increased residual volume and closing capacity and a blunted response to hypoxia and hypercarbia, causing an exaggerated respiratory depressant effect of anaesthetic drugs.

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TAKE ONLINE TEST

- Renal system: Decreased renal blood flow, glomerular filtration rate and functional changes in the kidneys lead to difficulty in maintaining electrolyte and fluid balance with altered excretion of medication.
- Hepatic system: A decrease in hepatic blood flow affects drug metabolism.
- Thermoregulation: Decreased subcutaneous fat deposition often places elderly patients at increased risk for heat loss and hypothermia.

TRAUMA AND PAIN MANAGEMENT IN ELDERLY PATIENTS

Unintentional falls contribute to 80% of fractures in elderly individuals. Impaired vision, impaired proprioception, electrolyte disturbance and postural hypotension contribute to falls and fractures. The most common sites involved are the spine, neck of the femur and hip joint. Even low-velocity and medium-velocity motor accidents can cause greater severity of chest and abdominal trauma as compared with younger individuals. Adequate hydration and nutritional support, pain management, early surgical intervention and mobilisation form the core principles of management of trauma in the elderly population.[2,3]

Benefits of Adequate Pain Management

- Early ambulation and decreased incidence of deep vein thrombosis
- Prevention of respiratory complications
- Decrease in release of catecholamines, thereby reducing cardiovascular ischemic events
- Prevention of postoperative cognitive dysfunction

Principles of Pain Management

A multidisciplinary approach to pain management is ideal but depends on available resources and the needs of the patient. Ideally, the team would include a physician, orthopaedic surgeon, anaesthesiologist, physiotherapist, social worker and occupational therapist. Attending nursing staff also plays an important role in the early detection of symptoms.[4]

In the earlier stages of dementia, when cognitive impairment is limited and communication ability is intact, self-report of pain is usually possible. There are several self-report scales, including the visual analog scale, the numerical rating scale and the faces pain scale.[5]

Multimodal analgesia helps in achieving better pain control at lower doses of individual drugs. This helps to avoid the side effects associated with higher drug doses, especially in elderly patients, who have altered pharmacokinetics and pharmacodynamics.

Pharmacodynamic and Pharmacokinetic Changes in the Elderly Population

Generally, older individuals are more sensitive to anaesthetic drugs because of alterations in receptor numbers and sensitivity, and less medication is usually required to achieve a desired clinical effect.

Factors that affect the pharmacologic responses in elderly patients are well described and include changes in plasma protein binding, body fat and water, drug metabolism and pharmacodynamics.

A decrease in total body water could lead to a smaller central compartment and increased serum concentrations after bolus administration of hydrophilic drugs. A decrease in lean body mass and increase in body fat may result in a greater volume of distribution, with the potential to prolong the clinical effect of lipophilic medications.

The circulating level of albumin decreases and α1-acid glycoprotein level increases, resulting in changes in the fraction of unbound drug.

The pharmacokinetics and pharmacodynamic changes seen in elderly patients are summarised in the Table.

MODALITIES OF PAIN MANAGEMENT

Oral and Parenteral Drug Preparations

- Paracetamol is an effective analgesic, particularly for musculoskeletal pain, and it is generally well tolerated with few side effects. It is important that the recommended maximum daily dose does not exceed 4 g/24 h. In addition, in cirrhotic patients, the maximum daily dose should not be more than 2 g/24 h.[6]
- Nonsteroidal anti-inflammatory drugs must be used with caution because of a high risk of potentially serious and life-threatening side effects, including acute renal failure, peptic ulceration and an increased risk of bleeding. They can be administered via oral, intravenous or per rectal routes. Because elderly patients are at an increased risk of gastrointestinal

	Changes With Normal Ageing	Clinical Consequence of Change
Absorption function of gastrointestinal tract	Delayed gastric emptying and reduced peristalsis	Alteration of drug absorption
Distribution	Decreased total body water Increased body fat Decreased plasma proteins	Reduced distribution of water-soluble drugs and increased half-life of lipid-soluble drugs
Hepatic metabolism	Decreased hepatic blood flow	Reduced first-pass metabolism
Renal excretion	Reduced renal blood flow	Reduced excretion of drugs
Pharmacodynamic changes	Increased receptor affinity	Increased sensitivity to therapeutic effects and increased risk of side effects

Table. Pharmacokinetic and Pharmacodynamic Changes in Elderly Patients

side effects, a proton pump inhibitor should also be co-prescribed. Particular attention should be paid to patients who are on angiotensin-converting enzyme inhibitors, diuretics or antiplatelets because of drug interactions.[7]

- Opioids should be considered, particularly in moderate to severe pain. There is marked variability in how individual patients respond to opioids; thus, treatment must be individualised and carefully monitored for efficacy and tolerability, with daily reevaluation. Patient-controlled analgesia provides a safer option in those with unimpaired cognition compared with continuous infusions but can be a challenge in patients with arthritis. Opioid side effects including respiratory depression, nausea and vomiting, delirium and urinary retention should be anticipated and managed accordingly. Laxative therapy, such as the combination of a stool softener and a stimulant laxative, should be prescribed throughout treatment.[8]
- Tramadol is a centrally acting analgesic with 2 mechanisms of action: it has a weak opioid agonist activity and inhibits serotonin reuptake. It has a reduced depressive effect on the respiratory and gastrointestinal systems in comparison with other opioids; however, confusion may be a problem for older patients. Tramadol may reduce the seizure threshold and is contraindicated in patients with a history of seizures.

Adjuvant Analgesics

N-methyl-D-aspartate receptor antagonists (ketamine, magnesium), membrane stabilisers (lidocaine), anticonvulsants (gabapentinoids), antidepressants (amitriptyline) and α-agonists (clonidine, dexmedetomidine) are particularly useful when used alone or in combination with other analgesics. When selecting an adjuvant agent, physicians should (1) prescribe medications with the lowest side effect profile for the geriatric patient, (2) titrate the drug slowly and (3) assess patients carefully for both effectiveness and the presence of adverse effects.[9,10]

Regional Anaesthesia Techniques

Regional anaesthesia has several beneficial effects in the elderly population, including better peripheral vascular circulation, suppression of surgical stress response and better postoperative pain control. Regional anaesthesia techniques include central neuraxial blockade, peripheral nerve, plexus and plane blocks.

The following factors have to be taken into consideration when using epidural analgesia in elderly patients[11]:

- Arthritic joints may interfere with the positioning of the patient. Calcified ligaments and intervertebral spaces and loss of normal spine curvatures may pose a challenge during epidural placement.
- There is a higher caudal spread of analgesia after epidural administration of a fixed dose of local anaesthetic solution because of progressive sclerotic closure of the intervertebral foramina.
- The clinical course of epidural anaesthesia may be influenced by a shift of the site of action from a predominantly paravertebral site in young patients to a subdural or transdural site in elderly patients.
- The dose of epidural or neuraxial opioids may need to be decreased because of increased sensitivity to drugs due to changes in the central and peripheral nervous systems.
- The connective tissue sheaths that cover the nerve tissues become weakened by the general deterioration in the mucopolysaccharides, allowing local anaesthetic solution to penetrate nerve sheaths more readily. The diameter and number of myelinated fibers in the dorsal and ventral nerve roots are decreased in elderly patients. In peripheral nerves, the inter–Schwann cell distance is decreased, as is conduction velocity. These changes tend to make older individuals more sensitive to neuraxial and peripheral nerve blocks.

The following points need to be kept in mind while performing regional techniques:

- These techniques are most often performed in a less than ideal environment, such as the emergency department or intensive care unit, and colonisation and infection of the catheter site are concerns while using an indwelling catheter.

- Consider the dose of local anaesthetic to avoid toxic plasma levels while placing multiple catheters.
- Coagulation parameters should be kept in mind while performing these blocks, and American Society of Regional Anesthesia or an equivalent guideline should be followed, as these patients are on antiplatelets/anticoagulants for their cardiac comorbidities.

Nonpharmacological Techniques

These techniques can help with pain management and can improve function. Examples include finding positions of comfort, splinting and early surgical stabilisation of fractures. Allied health professionals, such as physical therapists and psychologists, are able to provide complementary alternative medicinal therapies.

MANAGEMENT OF SPECIFIC INJURIES IN THE ELDERLY POPULATION

Chest Injury

Rib fracture is the most common injury resulting from blunt chest trauma. The fracture itself generally requires no specific treatment and will heal spontaneously over a period of several weeks. Therapy is directed at minimizing pulmonary complications secondary to these fractures, such as pain, splinting, atelectasis, hypoxaemia and pneumonia. Older patients with rib fractures have twice the mortality and thoracic morbidity of younger patients with similar injuries. Regional analgesic options include thoracic epidural, paravertebral block, erector spinae and serratus anterior block with or without a catheter. The Eastern Association for the Surgery of Trauma has stated that epidural analgesia may improve clinically significant outcomes and that it should be considered as the preferred analgesic modality. Paravertebral variants and fascial plane blocks as continuous catheter techniques are useful for patients with unilateral rib fractures or when an epidural is contraindicated in patients with coagulopathy, head and spine injuries and sepsis. Interpleural and intercostal blocks are other alternatives; however, their use is limited because of the high risk of rapid systemic absorption of local anaesthetics.[12]

Abdominal Injury

Placement of an epidural catheter can reduce the intraoperative analgesic requirement and can also be used for postoperative analgesia. The use of epidural analgesia is infrequent in emergency surgeries. Truncal blocks such as the transverse abdominis plane and rectus sheath block, among many others, can reduce postoperative opioid requirements.

Extremity Injuries

Upper Extremities

Upper-limb fracture fixation can be performed under peripheral nerve blocks such as interscalene and supraclavicular blocks.

Lower Extremities

Preoperative and postoperative femoral nerve block or fascia iliaca block can be used for femoral fractures either as a single-shot or continuous catheter technique. Placement of epidural catheters intraoperatively can provide postoperative analgesia for some lower-limb injuries, although in haemodynamically unstable patients, lumbar plexus block is another alternative. Site-specific blocks such as adductor canal and infiltration of local anaesthetic can provide analgesia without haemodynamic fluctuations and motor block.

Acute compartment syndrome (ACS), which is a serious soft-tissue injury that occurs following trauma, needs to be kept in mind while performing any upper- and lower-limb blocks. To date, there are no published cases of regional anaesthesia delaying the diagnosis of ACS. In contrast, there are several reports of pain breaking through a block, which has facilitated the early diagnosis of a developing ACS.[13]

SUMMARY

Most of the trauma in elderly individuals is the result of a mechanical fall. To prevent complications secondary to the injury, early surgical intervention and good pain relief is needed. A multimodal analgesic technique should be adopted while taking into account the associated comorbidities and altered pharmacokinetics and pharmacodynamics in elderly patients. Regular monitoring of treatment response and side effects is recommended. Good pain relief ensures enhanced mobility and recovery after a traumatic event in elderly patients.

REFERENCES

1. Miller RD, Cohen NH, Eriksson LI, Fleisher LA, Wiener-Kronish JP, Young WL. *Millers Anaesthesia*. 8th ed. Philadelphia, PA: Elsevier Saunders; 2014.
2. Rosen T, Mack KA, Noonan RK. Slipping and tripping: fall injuries in adults associated with rugs and carpets. *J Inj Violence Res*. 2013;5(1):61-69.
3. Berg RL, Cassells JS, eds. *The Second Fifty Years: Promoting Health and Preventing Disability*. Washington, DC: National Academies Press; 1992.
4. Makris UE, Abrams RC, Gurland B, et al. Management of persistent pain in the older patient: a clinical review. *JAMA*. 2014;312(8):825-836.
5. Cardno N, Kapur D. Measuring pain. *BJACEPD Rev*. 2000;2:7-10.
6. Rakoski M, Goyal P, Spencer-Safier M, Weissman J, Mohr G, Volk M. Pain management in patients with cirrhosis. *Clin Liver Dis (Hoboken)*. 2018;11(6):135-140.
7. Wongrakpanich S, Wongrakpanich A, Melhado K, Rangaswami J. A comprehensive review of non-steroidal anti-inflammatory drug use in the elderly. *Aging Dis*. 2018;9(1):143-150.
8. Chau DL, Walker V, Pai L, et al. Opiates and elderly: use and side effects. *Clin Interv Aging*. 2008;3(2):273-278.
9. Gomes T, Juurlink DN, Antoniou T, et al. Gabapentin, opioids, and the risk of opioid related death: a population-based nested case±control study. *PLoS Med*. 2017;14(10):e1002396.
10. Ramaswamy S, Wilson JA, Colvin L. Non-opioid-based adjuvant analgesia in perioperative care. *Contin Educ Anaesth Crit Care Pain*. 2013;13:152-157.
11. Hadzic A. *Nysora Textbook of Regional Anaesthesia and Acute Pain Management*. New York, NY: McGraw-Hill; 2007.
12. Fleming I. Regional anaesthesia for trauma: an update. *Contin Educ Anaesth Crit Care Pain*. 2014;14:136-141.
13. NYSORA. Regional anesthesia in patients with trauma. https://www.nysora.com/foundations-of-regional-anesthesia/sub-pecialties/trauma/regional-anesthesia-patients-trauma. Accessed 12 January 2020.